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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :

BOIRE PHILIPPE ET AL : EXAMINER: PIZIALI, A.

SERIAL NO: 09/923,353 :

FILED: August 8, 2001 : GROUP ART UNIT: 1775

FOR: SUBSTRATE WITH A PHOTOCATALYTIC COATING

# APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VA 22313

SIR:

Applicants appeal the Final Rejection dated June 6, 2003.

## I. REAL PARTY IN INTEREST

The real party in interest is Saint-Gobain Glass France, by virtue of an assignment executed on February 21, 2001.

## II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and their assignee are not aware of any appeals or interferences which will directly affect or be directly affected by or having a bearing on the Board's decision in this appeal.

## III. STATUS OF THE CLAIMS

The appealed claims are Claims 25-30, 34-39, 44, and 45, which are the only claims in the case.

## IV. STATUS OF THE AMENDMENTS FILED UNDER 37 C.F.R. §1.116

No amendments have been filed subsequent to the mailing of the Final Rejection. Appellants filed a Request for Reconsideration on December 8, 2003, but no amendments to the claims were submitted therein.

## V. THE APPEALED CLAIMS

A copy of the appealed claims is submitted in the Appendix attached hereto.

## VI. SUMMARY OF THE INVENTION

The present invention relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and obtained by thermal decomposition of titanium precursors selected from the group consisting of organo-metallic precursors and metallic halide precursors, wherein said coating has a thickness between 5 and 50 nm, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. [See the specification at

page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 8, lines 29-38; and page 13, line 30.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having a photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and a thin layer forming a barrier to alkali metals originating from the substrate, and located between said substrate and said coating, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 8, lines 29-38; and page 9, lines 8-12.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and wherein said coating is hydrophilic, and has a contact angle with water below 5 after exposure to luminous rays, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 1000 nm. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 6, lines 23-26; and page 8, lines 29-38.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and wherein said coating has a root mean square (RMS) rugosity between 2 and

20 nm, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 8, lines 3-9; and page 8, lines 29-38.]

The present invention also relates to a glass, ceramic or vitroceramic substrate provided on at least one of its faces with a coating having hydrophilic and/or photocatalytic properties and containing at least partially crystalline titanium oxide and having a thickness between 10 and 80 nm. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; and page 8, lines 29-38.]

In one embodiment, the glass, ceramic or vitroceramic substrate described above has a thickness between 20 and 50 nm. [See the specification at page 8, lines 29-38.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form, wherein said coating contains also at least one oxide with a lower refractive index than titanium oxide, the titanium content of the coating being at least 40%, by weight with respect to the total weight of oxides in the coating. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 4, lines 11-29; page 6, lines 23-26; and page 8, lines 29-38.]

In one embodiment, the coated substrate described above has a titanium content of least 50% by weight with respect to the total weight of oxides in the coating. [See the specification at page 4, lines 27-29.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form, wherein there is at least a layer arranged between the substrate and said coating, said layer being electrically conductive. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 8, lines 29-38; and page 9, lines 24-25.]

In another aspect of the invention, in the the coating described above, the conductive layer is selected from the group consisting of indium tin oxide, tin oxide doped with fluorine, tin oxide doped with antimony, zinc oxide doped with fluorine, zinc oxide doped with aluminium, zinc oxide doped with tin, tin oxides that are stoichiometrically deficient in oxygen, and zinc oxides that are stoichiometrically deficient in oxygen. [See the specification at page 9, lines 25-32.]

The present invention also relates to an electrically controlled variable absorption glazing wherein at least one of the external faces of said glazing is provided with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form. [See the specification at page 1, lines 3-9; page 2, and lines 37 to page 3, line 10.]

The present invention also relates to a windshield wherein at least the face of said windshield turned toward the inside of the passenger compartment is provided with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least

partly crystallized in the anatase form. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; and page 11, line 37.]

The present invention also relates to a coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least one of its faces with a coating with hydrophilic and/or photocatalytic properties, containing titanium oxide and doped by at least one metal selected from the group consisting of Nb, Ta, Fe, Bi, Co, Ni, Cu, Rh, Ce, and Mo. [See the specification at page 1, lines 3-9; page 2, lines 37 to page 3, line 10; page 5, lines 11-16; and page 8, lines 29-38.]

In one embodiment, in the coated substrate described above, the coating is deposited by reactive or non-reactive cathodic sputtering. [See the specification at page 3, lines 36-37.]

## VII. THE ISSUE OF THIS APPEAL

1. Whether Claims 25-27, 29-30, and 34-36 are unpatentable under 35 U.S.C. §102(e) over Vandiest (U.S. patent No. 5,721,054).

2. Whether Claims 25-27, 29-30, and 34-35, 39, and 44-45 are unpatentable under 35 U.S.C. §102(e) over Teowee (U.S. patent No. 5,604,626).

3. Whether Claims 25-30 under 35 U.S.C. §103(a) over Kato (U.S. patent No. 6,284,314) is respectfully traversed.

4. Whether Claim 39 is unpatentable under 35 U.S.C. §103(a) over Vandiest.

## VIII. GROUPING OF THE CLAIMS

The claims do not stand or fall together. The reason for them not standing or falling together will be pointed out and discussed below.

## IX. ARGUMENTS IN TRAVERSAL OF THE REJECTION

### 1. Claims 25-27, 29-30, and 34-36 Are Not Unpatentable Under 35 U.S.C. §102(e) Over Vandiest (U.S. patent No. 5,721,054).

An important feature of the claimed substrate is that it has a coating comprising at least partially crystalline titanium oxide and where the coating has photocatalytic properties or hydrophilic and/or photocatalytic properties.

Appellants submitted an executed Rule 132 Declaration of Dr. Léthicia Guéneau (hereinafter referred to as "the Declaration") with the Request for Reconsideration on December 8, 2003. Dr. Guéneau has eight years of experience in the field of physico chemistry/self-cleaning glass (see paragraphs (1) and (2) of the Declaration).

According to Dr. Guéneau, Vandiest describes a glazing panel produced by pyrolytic coating of a substrate (see the Abstract). The coating contains an absorbent layer comprising at least one oxide selected from chromium, cobalt, and iron. The coating also contains a non-absorbent layer which comprises a material having a refractive index within the range of 1.4 to 3.0 (see the Abstract). The purpose of the coating is to have low solar factor and a high purity of reflected color (see column 2, lines 13-17). Vandiest fails to describe that the coating described therein is photocatalytic or hydrophilic. See paragraph (5) of the Declaration.

In Example 2, Vandiest describes a glass substrate coated with a 41 nm $TiO_2$ layer, which, in turn, is coated with a layer of Fe, Co, and Cr oxides having a thickness of 45 nm.

Dr. Guéneau points out that in Example 2, Vandiest describes a glass substrate coated with a 41 nm $TiO_2$ layer, which, in turn, is coated with a layer of Fe, Co, and Cr oxides having a thickness of 45 nm (see paragraph (6) of the Declaration). In Example 3, Vandiest describes a glass substrate coated with a 85 nm $TiO_2$ layer, which, in turn, is coated with a layer of Fe, Co, and Cr oxides having a thickness of 46.5 nm (see paragraph (7) of the Declaration). According to Dr. Guéneau, Fe, Co, and Cr oxides are well-known to be poisons for photocatalysts. Therefore, one of ordinary skill in the art would limit the contents of those metal oxides because of their known properties as photocatalyst poisons (see paragraph (8) of the Declaration).

Based on the foregoing, Vandiest fails to describe the claimed coated substrate.

**2. Claims 25-27, 29-30, and 34-35, 39, and 44-45 Are Not Unpatentable Under 35 U.S.C. §102(e) Over Teowee (U.S. patent No. 5,604,626).**

An important feature of the claimed substrate is that it has a coating comprising at least partially crystalline titanium oxide and where the coating has photocatalytic properties or hydrophilic and/or photocatalytic properties.

According to Dr. Guéneau, Teowee describes a photochromic device which allows a user to leave the device in a high transmissive state even when exposed to a source of radiation (see the Abstract). The device contains a radiation sensitive electrode 30 (see columns 7 and 8). Teowee fails to describe that the coating described therein is photocatalytic or hydrophilic. See paragraph (10) of the Declaration.

In addition, Dr. Guéneau points out that the absence of a binder, especially in Example 1, leads to coatings with very low mechanical strength (see paragraph (11) of the Declaration). Moreover, the operation involves heating to 450°C or 350°C, and, in the absence of a barrier layer, does not result in effective photocatalyst (see paragraph (11) of the Declaration).

In view of the foregoing, Teowee fails to describe the claimed coated substrate.

### 3. Claims 25-30 Are Not Unpatentable Under 35 U.S.C. §103(a) Over Kato (U.S. patent No. 6,284,314).

According to Dr. Guéneau, the thickness of the coatings described by Kato is much greater than 50 nm. In the Examples of that reference, the coating thickness is 400 nm (Example 1), 500 nm (Example 2), 300 nm (Example 3), 400 nm (Example 4), 600 nm (Example 5), 400 nm (Example 6), 800 nm (Example 7), 600 nm (Example 8), 0.5 μm (Example 9), 0.4 μm (Example 10), 0.3 μm (Example 11), 0.5 μm (Example 12), 0.4 μm (Example 13), and 0.8 μm (Example 14). Thus, the thinnest coating described in the reference is 300 nm. See paragraph (13) of the Declaration.

Dr. Guéneau points out that in describing the procedure for preparing the coating, Kato states:

> it is desirable to produce a multilayer film by repeating a procedure which comprises depositing thinly and uniformly the ceramic sol...on a substrate...thereby forming a thin film of the solution on the substrate.... As a result, a sturdy porous ceramic thin film excellent in durability can be obtained. [Column 3, lines 33-42.] See paragraph (14) of the Declaration.

In addition, Dr. Guéneau notes that Kato is completely silent regarding the size of titanium oxide crystallites (see paragraph (15) of the Declaration). According to Dr. Guéneau, the reference also fails to describe the contact angle or the root mean square (RMS) rugosity of the coating (see paragraph (16) of the Declaration). Dr. Guéneau also points out that Kato fails to explicitly disclose a layer which functions as a barrier to alkali metals originating from the substrate, and that the reference does not suggest that such a component would be desirable. See paragraph (19) of the Declaration.

According to Dr. Guéneau, there is no suggestion in Kato to produce a coating having a thickness which is 5 to 80 nm. Kato specifically directs one to prepare a coating using a multiple dipping technique, which would not suggest a coating that was only approximately 1/4 the thickness of the thinnest coating described in the reference. In Dr. Guéneau's opinion, Kato certainly fails to suggest a coating which is 5 to 50 nm, which is only 1/6 as thick as the thinnest coating described in that reference. See paragraph (17) of the Declaration.

According to Dr. Guéneau, Kato also fails to suggest that the titanium crystallites have an average size of between 60 and 100 nm, since the reference fails to even mention titanium crystallites at all. See paragraph (18) of the Declaration.

In Dr. Guéneau's opinion, Kato is completely silent with respect to the RMS rugosity of the coating and, therefore, fails to suggest a coating having a value between 2 and 20 nm. See paragraph (21) of the Declaration.

In addition, Dr. Guéneau points out that Kato describes the optional heating of solutions coated on substrates in the absence of a barrier layer to alkalis, such as sodium from

the substrate. Quartz glass substrates are described, which consist of $SiO_2$, and do not contain alkalis. See paragraph (22) of the Declaration.

Claim 25 specifies, *inter alia*, that the coating has a thickness between 5 and 50 nm and the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. The thinnest film described in the reference is 300 nm. There is no suggestion in Kato to produce a coating having a thickness which is 5 to 50 nm as claimed. Kato specifically directs one to prepare a coating using a multiple dipping technique, which would not suggest a coating that was only 1/6 the thickness of the thinnest coating described in the reference. Moreover, Kato fails to suggest that the titanium crystallites have an average size of between 60 and 100 nm, since the reference fails to even mention titanium crystallites at all. Accordingly, Kato fails to suggest the coated substrate recited in Claim 25.

Claim 26 recites, *inter alia*, (1) a thin layer a thin layer forming a barrier to alkali metals originating from the substrate, which is located between the substrate and the coating, and (2) that the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. Kato does not identify a layer which functions as a barrier to alkali metals originating from the substrate, nor does the reference suggest that such a component would be desirable. Kato fails to suggest that the titanium crystallites have an average size of between 60 and 100 nm, since the reference fails to even mention titanium crystallites at all. Accordingly, Kato fails to suggest the coated substrate recited in Claim 26.

Claim 27 specifies, *inter alia*, (1) that the coating has contact angle with water below 5° after exposure to luminous rays and (2) that the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. Kato is completely silent with

respect to the contact angle of the coating and, therefore, fails to suggest a coating having a value below 5° as claimed. In addition, Kato fails to suggest that the titanium crystallites have an average size of between 60 and 100 nm, since the reference fails to even mention titanium crystallites at all. Accordingly, Kato fails to suggest the coated substrate recited in Claim 27.

Claim 28 specified, *inter alia*, (1) that the coating has an RMS rugosity between 2 and 20 nm and (2) that the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. Kato is completely silent with respect to the RMS rugosity of the coating and, therefore, fails to suggest a coating having a value between 2 and 20 nm. In addition, Kato fails to suggest that the titanium crystallites have an average size of between 60 and 100 nm, since the reference fails to even mention titanium crystallites at all. Accordingly, Kato fails to suggest the coated substrate recited in Claim 28.

Claim 29 specifies, *inter alia*, that the coating has a thickness between 10 and 80 nm and the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm. The thinnest film described in the reference is 300 nm. There is no suggestion in Kato to produce a coating having a thickness which is 5 to 50 nm as claimed. Kato specifically directs one to prepare a coating using a multiple dipping technique, which would not suggest a coating that was only about 1/4 the thickness of the thinnest coating described in the reference. Accordingly, Kato fails to suggest the coated substrate recited in Claim 29.

Claim 30 specifies, *inter alia*, that the coating has a thickness between 20 and 50 nm and the crystallized titanium oxide is in the form of crystallites with an average size of

between 60 and 100 nm. The thinnest film described in the reference is 300 nm. There is no suggestion in Kato to produce a coating having a thickness which is 5 to 50 nm as claimed. Kato specifically directs one to prepare a coating using a multiple dipping technique, which would not suggest a coating that was only 1/6 the thickness of the thinnest coating described in the reference. Accordingly, Kato fails to suggest the coated substrate recited in Claim 30.

**4. Claim 39 Is Not Unpatentable Under 35 U.S.C. §103(a) Over Vandiest.**

Claim 39 recites a windshield wherein at least the face of said windshield turned toward the inside of the passenger compartment is provided with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form.

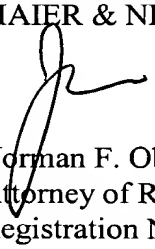
As noted by Dr. Guéneau above, the purpose of the coating described in Vandiest is to have low solar factor and a high purity of reflected color (see column 2, lines 13-17 of the reference). Vandiest fails to describe that the coating described therein is photocatalytic or hydrophilic. In addition, as recognized by the Examiner, the glazing described by Vandiest is to be used for architectural buildings and not as a windshield. See paragraph (23) of the Declaration. In view of these differences, the reference fails to suggest the claimed windshield.

## X. RELIEF REQUESTED

Reversal of the Examiner's rejections of the appealed claims under 35 U.S.C. §102(e) and 35 U.S.C. §103(a) is requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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## APPENDIX

Appealed Claims 25-30, 34-39, 44, and 45 of the above-identified application read as follows:

25. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and obtained by thermal decomposition of titanium precursors selected from the group consisting of organo-metallic precursors and metallic halide precursors, wherein said coating has a thickness between 5 and 50 nm, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm.

26. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having a photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and a thin layer forming a barrier to alkali metals originating from the substrate, and located between said substrate and said coating, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm.

27. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and wherein said

coating is hydrophilic, and has a contact angle with water below 5 after exposure to luminous rays, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 1000 nm.

28. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having photocatalytic properties, and comprising titanium oxide at least partly crystallized in the anatase form, and wherein said coating has a root mean square (RMS) rugosity between 2 and 20 nm, wherein the crystallized titanium oxide is in the form of crystallites with an average size of between 60 and 100 nm.

29. Glass, ceramic or vitroceramic substrate provided on at least one of its faces with a coating having hydrophilic and/or photocatalytic properties and containing at least partially crystalline titanium oxide and having a thickness between 10 and 80 nm.

30. The glass, ceramic or vitroceramic substrate according to claim 29, wherein said thickness is between 20 and 50 nm.

34. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form, wherein said coating contains also at least one oxide with a lower refractive index than

titanium oxide, the titanium content of the coating being at least 40%, by weight with respect to the total weight of oxides in the coating.

35. The coated substrate according to claim 34, wherein said titanium content is at least 50% by weight with respect to the total weight of oxides in the coating.

36. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least a portion of one of its faces with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form, wherein there is at least a layer arranged between the substrate and said coating, said layer being electrically conductive.

37. A coating according to claim 36, wherein the conductive layer is selected from the group consisting of indium tin oxide, tin oxide doped with fluorine, tin oxide doped with antimony, zinc oxide doped with fluorine, zinc oxide doped with aluminium, zinc oxide doped with tin, tin oxides that are stoichiometrically deficient in oxygen, and zinc oxides that are stoichiometrically deficient in oxygen.

38. An electrically controlled variable absorption glazing wherein at least one of the external faces of said glazing is provided with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form.

39. A windshield wherein at least the face of said windshield turned toward the inside of the passenger compartment is provided with a coating having hydrophilic and/or photocatalytic properties and comprising titanium oxide at least partly crystallized in the anatase form.

44. A coated substrate which is a glass, ceramic or vitroceramic substrate provided on at least one of its faces with a coating with hydrophilic and/or photocatalytic properties, containing titanium oxide and doped by at least one metal selected from the group consisting of Nb, Ta, Fe, Bi, Co, Ni, Cu, Rh, Ce, and Mo.

45. The coated substrate according to claim 44, wherein the coating is deposited by reactive or non-reactive cathodic sputtering.